A PROPOSAL SUBMITTED BY THE
UNIVERSITY OF HAWAII

TO: U.S. Army Engineer Research and Development Center (ERDC)
ERDC Contracting Office (ECO)
3909 Halls Ferry Road
Vicksburg, MS 39180

U.S. Army Contact(s): Amanda I. Campbell

PROJECT TITLE: Lahaina Groundwater Tracer Study, Lahaina, Maui, Hawaii

DEPARTMENT: Geology & Geophysics

PROJECT PERIOD: 04/15/11 - 12/31/11

AMOUNT REQUESTED: $118,252

PRINCIPAL INVESTIGATOR:
DATE: 3/14/2011

Dr. Craig Glenn

DEAN:
DATE: 3/14/11

Dr. Brian Taylor

AUTHORIZING UNIVERSITY OFFICIAL:
DATE: 3/16/11

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Please ensure that all correspondence regarding this application and project are addressed to the Office of Research Service

INTRODUCTION

The purpose of this proposal is to provide critical data about the hydrological connection between the effluent discharge and the coastal waters, confirm the locations of emerging discharge of injected effluent into the coastal marine waters and determine a travel time from the Lahaina Wastewater Reclamation Facility's (LWRF) injection wells to coastal waters.

Specifically, this proposal is to complete the work for Phase I of the Planning Assistance Agreement Between the Department of the Army (Phase I) and the State of Hawaii, Department of Health (Phase II). The proposal presented here is designed to stand independently and be full executable to the Army, especially with regards to the stated objectives in Statement of Interest W912HZ-11-SOI-0010, Lahaina Groundwater Tracer Study, Lahaina, Maui, Hawaii. At the same time, however, we have also designed this proposal to work effectively and seamlessly with our companion proposal to the Department of Health for Phase II.

As detailed in the following sections, the principal objectives of the research proposed here include:

- Review of Literature, Research Publications, and Prior Studies (Objective 1),
- Field Reconnaissance Studies (Objective 2)
- Develop a Tracer Study Design and Work Plan (Objective 3), and
- Background Assessment and Monitoring (Objective 4).

At the conclusion of both Phase I and II, we will produce a compressive, EPA- and DOH-reviewed Final Report on our finding and interpretations which will provide an accurate, unbiased, and scientifically-defensible information related to the hydrologic connection between effluent discharges from LWRF and coastal waters (Objective 5).

SCOPE OF WORK

Objective 1: Review of Literature, Research Publications and Prior Studies

Examples of our Objective 1 literature and prior studies review include:

- Aerial/satellite photographs,
- Topographic maps,
- Geologic/hydrologic documents and maps,
- Well logs,
- Coastal bathymetry,
- Previous reports and research about the site.

These reviews will be conducted as background research for our team research plan, design and execution with respect to all known site-specific geology, hydrology, groundwater flow patterns, and tracer study techniques. Past studies, for example, include previous tracer studies in Hawaii, and on Maui (e.g. TetraTech, 1994), and potential linkages between effluents as causes of algae blooms (e.g. Dollar and Andrews, 1997; Borke, 1996). More recent scientific investigations include Hunt and Rosa's (2009) multi-tracer approaches to detecting effluent discharges at Lahaina and Kihei on Maui, Dailer et al.'s (2010) extensive work using stable isotope data from near-shore cultivated algae, and recent groundwater investigations for West Maui modeling by the USGS (Gingerich, 2008). Other sources of data will include UH and USGS published studies and Reports, past Environmental Impact Drafts and Reports, Underground Injection Control permit renewal application, etc.

Objective 2: Field Reconnaissance

During this phase of the project we will conduct both ground-based and airborne field reconnaissance studies to support the best possible study design and to ensure a successful tracer study.

<u>Airborne Thermal Infrared Mapping</u>

High-resolution thermal mapping will be used to study submarine groundwater discharge (SGD) to ascertain accurate depiction of the exact ocean input locations, overall areal extent and distribution, and seaward oceanic mixing of water from terrestrial and ocean water. This can be achieved by georeferenced, temperature-corrected, airborne thermal infrared (TIR) mapping. Our group is among the world's leading experts in this technique, having experience with both warm and cool water marine seeps, and because our costs are in-house, they are a small fraction of that obtainable via commercial contract (typically ~$100K). Two recent examples of the type of product we will produce and use in this project are illustrated in **Figures 1 and 2.** In addition to precisely pinpointing discharge points, and mapping the overall spatial extent of the discharges,

these thermal images will form the necessary and fundamental base maps for coordinating the land- and ocean-based activates of the Project.

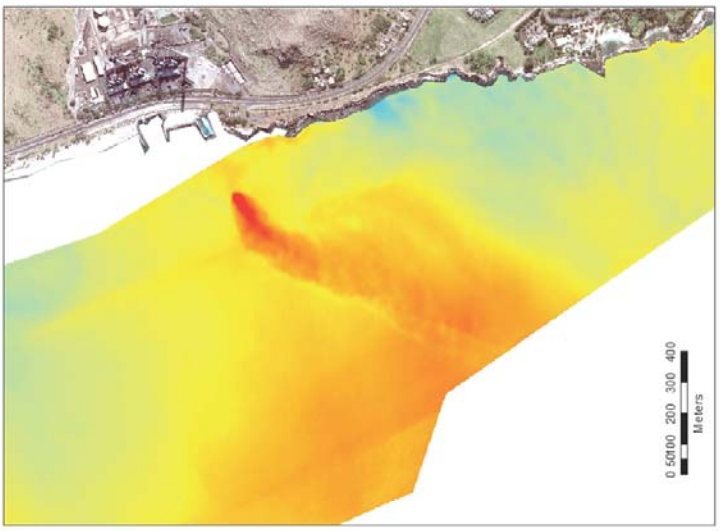


Figure 1. Warm water power plant effluent discharge (from 2134 m elevation) from offshore Kahe ("Electric Beach") area, Oahu (17 July 2009, 0450Hrs). Buoyantly-upwelling warm effluent (red), discharging from 8 meters below sea level, is clearly visible and precisely mapped in the surface waters, as is the nearby cool-water SGD discharge to the right (blue-greens). The power plant discharge is approximately 5 to 6°C warmer than ambient ocean water, and the in situ spatial temperature resolution in is <0.5°C per 3.2 meters.

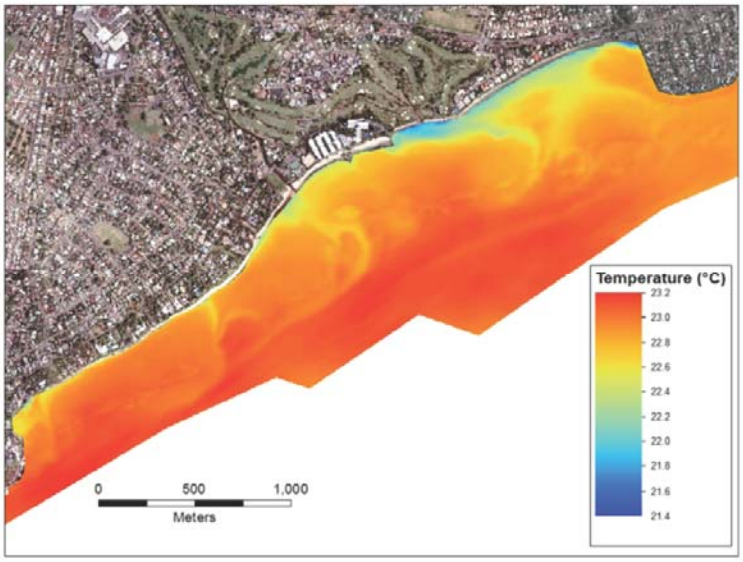


Figure 2. Aerial TIR map (from 2134 m elevation) of Diamond-Head - Wailupe area, Oahu (22 July 2009, 0200 Hrs). Blues-to-yellows are submarine ground waters (SGD) mixing by into the ambient ocean water (red). Note clear southwest current entrainments of SGD plumes towards Diamond Head (not pictured) in bottom left. Spatial temperature resolution is <0.5°C per 3.2 meters. For more examples also see http://www.soest.hawaii.edu/GG/FACULTY/glenn/images/Kiholo2_TIR3_121807.jpg

TIR Utilization for the Tracer Test Study

The TIR surveying method will be used because there are temperature and density differences between coastal marine waters and discharging terrestrial groundwaters and effluents. This approach is ideal for this project, as it will allow extremely precise groundwater input differentiation between both the warm water effluent and the natural cool water SGD seeps within and along many 10s of kilometers adjacent to the most pronounced effluent discharge site. Injected effluent is warmer than groundwater outside the plume, and the submarine springs at Kahekili Beach near Lahaina are notably described as "warm seeps." Hunt and Rosa (2009) demonstrated that the temperatures near the Kahekili Beach springs were elevated, and their work showed that at the Kihei injection site the effluent (27.5°C) was 7°C warmer than regional groundwater (20.5°C at an up-gradient well). These temperature differences between groundwater, effluent, and seawater are clearly resolvable with our technique. Because the cooler SGD and warm effluent are less saline than the coastal seawater, it is extremely likely that both produce buoyant point-sourced "plumes" at a wide variety of scales, as well as more diffuse discharges, all of which will be differentiated and mapped within the study area using aerial sea surface thermal imaging.

TIR Approach and Test Timeframe

The geo-referenced aerial thermal infrared base map will be produced at the onset of the study to precisely and accurately map and delineate inputs and emergence points of normally cold groundwater seepages vs. points where the warmer effluent waters emerge, with a resultant precision of $<0.5^{o}C$ within each one m^2 pixel. Our time estimate for the TIR maps is days for preliminary processing for immediate use, and 2-3 weeks for final ground-truth temperature corrected digital maps.

The flight survey will be conducted at 5000' feet altitude using a TIR spectrometer (sensitivity of $0.1^{o}C$) mounted in an aircraft's fuselage. To eliminate solar heating and minimize land-sea thermal contrast, TIR flight accusation will take place overnight between approximately 0200hrs (departing from Oahu) and 0530hrs (returning to Oahu). After the aerial surveys, all flight line images will be spectrally calibrated to blackbody measurements acquired during the flight. All spectral bands between 8.1 and 11.0 nm in the calibrated images will be averaged to a single band and subsequently converted to temperature by inverting the Planck Equation. The temperature-converted imagery will be georeferenced using the aircraft's navigational parameters, referenced to regional aerial photographs using tie points, and then mosaicked to form high-resolution surface water temperature maps. The temperatures in the mosaicked images will then be calibrated to field emplaced *in situ* thermistors (accuracy = $0.5^{o}C$; field plan described below) to correct for atmospheric interferences (e.g. water vapor and aerosols) between the ocean's surface and the airborne sensor.

TIR Ground Truthing

This initial phase of fieldwork will occur in close coordination with the TIR flight and is critical for making accurate corrections between the TIR flight data and *in situ* surface water temperatures. During this operation, a network array of approximately 32 *in-situ* self-recording thermistors will be deployed throughout the study area during the day prior

to the night of the TIR flight accusation, and retrieved during the day immediately following. The field team for this operation will also be in direct cellular contact to satellite weather interpretation via the NOAA Weather Service Office personnel in Honolulu (housed at the Hawaii Institute of Geophysics Building, SOEST), and will work through the night to advise the flight operation crew of this data and their own ground-observed conditions of cloud cover via cellular and radio.

Objective 3: Develop a Tracer Study Design and Work Plan

Our goal is to design a tracer study that will provide the best estimate of travel time from the injection wells to the coastal discharge points and provide a firm basis for estimating the total flux of effluent to the near shore environment. Objective 3 will incorporate data gathered in all the other Objectives of this proposal into a groundwater flow and transport model. This model will be capable of simulating freshwater/seawater interaction as well as the transport of the tracer dye. The transport module of the model will be capable of simulating sorption and tracer degradation. Importantly, this model will be used to determine the amount of tracer to be injected, the injection duration, and the sampling frequency.

Tracer Selection and Amount
The type of tracer(s) used will be defined and consider characteristics such as the minimum detection concentration, aesthetic suitability, method of detection, the ability to detect the tracer in the field, amount of sorption of the tracer on aquifer matrix, the persistence of the tracer, interference with other constituents in the near shore water, environmental safety, and the ease of introduction into the LWRF effluent path. The tracer selected will remain detectable even when undergoing the maximum expected dilution, but not injected in concentration that would be visually objectionable if little dilution were to occur.

Dye Release Procedures
Based on the field reconnaissance and numerical modeling, tracer release procedures will be developed that will maximize the probability that tracer detection will result in a sufficient number of data points to allow full characterization of the break through curve. Also considered will be simultaneous or successive tracer tests using one or more tracers. This could include, for example, injection of different tracers in different wells to determine the relative connectivity each well to the near shore seeps.

Tracer Study Area
Based on the results of the previous tasks, the area(s) to be monitored will be identified to minimize the possibility that near-shore tracer discharge points will be missed.

Monitoring Strategy
Our groundwater flow and transport models will be used to predict tracer-breakthrough characteristics and time intervals needed for effective sample of the passage of the tracer. When we develop the monitoring strategy, we will be accounting for background fluorescence, timing for detecting the first emergence of the tracer, and what constitutes a

positive versus a negative (non-detect) tracer analytical result. As part of this task, the sample collection, field screening, final analysis, and sample storage/preservation procedures will be documented. Procedures for collection of other constituents such as nitrogen species, silica, salinity, etc. that are helpful in interpreting the tracer test will be listed and the same collection, storage, and analysis will also be included.

Tracer Study Design Proposal
This will be a brief written proposal outlining the proposed tracer study design, including, but not limited to, the amount of and type of tracer needed for injection, dye release procedures, predicted tracer-breakthrough characteristics, sampling methods, and the time interval needed for effective sampling of the passage of the tracer. This proposal shall be subject to changes through discussion the HDOH, USACE, Maui County, and EPA prior to finalization of the Tracer Study Work Plan.

Tracer Study Work Plan
We will produce a written work plan that explicitly describes how the test will be conducted, how much of which tracer(s) will be used, where injected, where sampled, for how long, etc. The Work Plan will also include a monitoring plan for background and tracer detection. Attachments for the Work Plan will include a sample and analysis plan, Quality Assurance/Quality Control procedures (for the field and laboratory), and a proposed tracer study schedule.

Objective 4: Background Assessments

Objective 4 is to conduct an integrated set of pre-tracer injection background assessments and monitoring studies to ground-truth and best define and differentiate the location of effluent seepage sites that will contain our subsequent specific dye tracers, and which will determine background concentrations and characteristics of groundwater from man-made substances and natural interference.

The initial design work will consist of determining the optimum dye-release practices, the sampling locations, and the sampling strategy to best ensure a successful test. To support these efforts, a field survey will be completed which will include locating the submarine seeps in the near-shore marine waters (these will include the four major seeps identified by Dailer et al., 2009), and touring the LWRF to become familiar with operation, maintenance, and performance of the injection wells to consider for the dye-release procedures. To further facilitate the tracer test design, interviews will be conducted with local experts, including those from the Department of Land and Natural Resources – Division of Aquatic Resources personnel, LWRF personnel, U.S. Geological Survey personnel that have previously studied the area, and University of Hawaii researchers that have previously studied the area.

This field reconnaissance will also involve the investigation of other potential emergence points. A portion of the fieldwork should be completed under conditions of moderate to high injection well flow and low tide so the dominant emergence points are active. The

locations of potential monitoring locations will be recorded using Global Positioning Satellite (GPS) technology.

Background monitoring will be conducted at identified sampling locations to identify sources and levels of background fluorescence that may interfere with analyzing samples for dye concentration. The results of this survey will be incorporated into the Sampling and Analysis, and the Quality Assurance/Quality Control Plans. The primary purpose of this data will be to aid in the interpretation of the dye samples. The background sampling will cover a period starting two-weeks prior to dye injection and continue to the day of injection to determine the variability of background fluorescence.

Radon Monitoring and Radon Surveys

We will measure and monitor naturally-occurring radioisotopes of radon and radium to validate and further investigate the results of the TIR Aerial Survey by focusing on targets areas in those results, as well as at the seep sites previously identified and past studies (e.g. Hunt and Rosa, 2009; Dailer et al., 2010). Radon and radium are released from rocks and sediments within the aquifer and groundwater flowing through these gets highly enriched in these isotopes. Ocean water contains negligible concentrations and this high concentration gradient makes these isotopes excellent tracers of subterranean groundwater discharge. We will measure these isotopes along the coastal zone encompassing at least 5 km of the coastline to also include areas adjacent to the location where the plume is thought to be discharging, and with these measurements we will identify and differentiate the source(s) of discharging water (fractions of fresh groundwater, injectate, recirculated seawater). We will complete continuous coastal surveys with an autonomous radon sensor, which will be used for both the spatial survey (mapping) and time-series monitoring. For the spatial survey, we will employ two of these instruments at the same time, one looking at the surface plumes and one at benthic inputs. In addition, radium samples will be collected and analyzed. From the chemical mass balance and isotope signatures of the individual water masses we will thus be able to assess each localized groundwater discharge flux with special focus on the locations where the injectate plume(s) are thought to be discharging, and also including a wider area to identify any additional discharge sites that have not been previously considered or were not found because they are too diffuse or far offshore. We will also be able to quantify the variability of the specific background and effluent discharge rates over the time duration of Objective 4 (2 week minimum), as well as be able to uniquely position ourselves for integration of these results into the longer-term monitoring efforts planned for Phase II.

Geochemical Sampling

To estimate fluxes of injected wastewater into the ocean at different groundwater portals in this part of Objective 4, we will estimate the volumetric fraction of wastewater in the groundwater and multiply that by the groundwater velocity we estimated seepage velocity measurements (i.e. Rn/Ra above, and Acoustic Current Velocity Profiler below). Groundwater discharged to the ocean from the Lahaina coastline is the final chemical mixtures of several chemically distinct starting “source water end members,” particularly (1) WWTP injectate, (2) agricultural effluent, (3) soil water, and (4) recirculated

subterranean ocean water. The goal of the geochemical modeling portion of Objective 4, therefore, is to quantify the portion of each of these source water end-members in order to isolate the WWTP injectate fraction is greatest. Carbon isotopes will be used to distinguish between dominant inputs via soil waters, anthropogenic activity, and rainfall/ocean water sources in groundwater. Nitrogen isotopes of the dissolved nitrate in the waters will be utilized to identify natural and anthropogenic sources of nitrate (commercial fertilizers vs. organic soil nitrate vs. human waste) (e.g. Kendall and McDonnell, 1998, and papers therein. $\delta^{18}O$ values of dissolved nitrate allow delineating between atmospheric nitrate, fertilizer nitrate, and soil nitrate. We will also deploy our team's conductivity-depth-temperature loggers either directly within or adjacent to several seeps to record any changes in the seep discharge salinity attributable to the changes in the volume of the injected effluent. These flux estimates will then be compared to those derived from the radon/radium isotope systematics described above to validate and refine where the maximum discharge estimates of all the injectate occurs so as to best position ourselves for the coastal portions of the tracer test of Phase II of the project.

Seep Discharge Characterization

We will use the data collected during the radon mapping and geochemically sampling, combined with direct discharge measurements at seeps, to quantify the specific flow velocity and lateral dispersion of the freshwater discharge and its component effluent to the near-shore environment. The seep discharge rates will be measured directly using a YSI AquaDopp Profiler® (an Acoustic Doppler Current Profiler, or ADCP). This instrument, as equipped with a 1 megahertz right angle head, will be used to profile current velocities in three dimensions over distances as short as 1 meter, or as long as 100 meters. We will deploy the ADCP in the close proximity mode to measure a three dimensional profile of the current discharging from each major seep we identify. When combined with chemical partitioning results described above, the ADCP measured profiles will also further quantify the volume and specific flow rate of natural groundwater and possible effluent contributions discharging from each seep. A rudimentary time of travel from an injection point to a coastal discharge point can also be estimated from this data, which will greatly aid us in refining our calculations for rates of Tracer Dye additions and durations during Phase II or the Project.

Objective 5: Drafts and Final Reports

At the conclusion of both Phase I and II, we will produce a compressive, EPA- and DOH-Draft reviewed Final Report on our findings and interpretations which will provide an accurate, unbiased, and scientifically-defensible information related to the hydrologic connection between effluent discharges from LWRF and coastal waters

REFERENCES

Bourke, R., 1996, Maui algae bloom studies-distribution and abundance: Honolulu, Hawaii, Oceanit Laboratories, Inc.

Dailer, M.L., Knox, R.S., Smith, J.E., Napier, M., and Smith, C.M., 2010, Using $\delta^{15}N$ values in algal tissue to map locations and potential sources of anthropogenic nutrient inputs on the island of Maui, Hawaii, USA, Marine Pollution Bulletin. 60(5), pgs 655-671

Dollar, S., and Andrews, C., 1997 Algal blooms off West Maui-assessing casual linkages between land the coastal ocean: Honolulu, University of Hawaii Final Report, 40p.

Gingerich, S.B., 2008, Ground-water availability in the Wailuku area, Maui, Hawaii: U.S. Geological Survey Scientific Investigations Report 2008-5236, 95p.

Hunt, C.D. Jr., and Rosa, S.N., 2009, A Multitracer approach to detecting wastewater plumes from municipal injection wells in nearshore marine waters at Kihei and Lahaina, Maui, Hawaii: U.S. Geological Survey Scientific Investigations Report 2009-5253, 166p.

Kendall, C., and McDonnell, J.J. eds., 1998, Isotope tracers in catchment hydrology: Amsterdam, Elsevier Science, 839p.

Tetra Tech, Inc., 1994, Effluent fate study, Lahaina wastewater reclamation facility, Maui, Hawaii: Prepared for U.S. Environmental Protection Agency Region 9, 73p. plus appendixes.

Lahaina Groundwater Tracer Study Lahaina, Maui, Hawaii - Budget Summary						
PIs: Craig Glenn, Aly El-Kadi, Henrieta Dulaiova, Meghan Dailer		**Objective 1**	**Objective 2**	**Objective 3**	**Objective 4**	
A. SENIOR PERSONNEL	rate	**Literature Review**	**Field Reconn.**	**Tracer Study Design & Work Plan**	**Background Assessment**	**PHASE I TOTALS**
1. Glenn (0.5 month reg)	38.27%				$4,580	$4,580
2. El-Kadi (0.5 month summer)	2.29%		$5,527			$5,527
3. Dulaiova (0.5 month summer)	2.29%		$4,355			$4,355
4. Dailer (0.5 month reg)	38.27%				$2,292	$2,292
TOTAL SENIOR PERSONNEL			*$9,882*		*$6,872*	***$16,754***
B. OTHER PERSONNEL						
1. Whittier (2.25 mo reg)	38.27%	$2,967		$2,967	$2,967	$8,901
Total - Other Personnel		*$2,967*	*$0*	*$2,967*	*$2,967*	***$8,901***
Graduate Students:						
1. Kelly (2 mos summer)	2.29%				$4,354	$4,354
2. Waters (2 mos summer)	2.29%				$4,186	$4,186
3. Fackrell (2 mos summer)	2.29%				$4,186	$4,186
Total - Graduate Students		*$0*	*$0*	*$0*	*$12,726*	***$12,726***
Undergraduate Student						
1. Undergraduate student (1 mo)	0.40%	$2,000				$2,000
Total - Undergraduates		*$2,000*	*$0*	*$0*	*$0*	***$2,000***
TOTAL SALARIES & WAGES		*$4,967*	*$9,882*	*$2,967*	*$22,565*	**$40,381**
C. FRINGE BENEFITS		*$1,143*	*$226*	*$1,135*	*$4,057*	**$6,561**
TOTAL SALARIES, WAGES & FRINGE		*$6,110*	*$10,108*	*$4,102*	*$26,622*	**$46,942**
D. EQUIPMENT						
ADCP 3-D Current Profiler					$19,000	**$19,000**
E. TRAVEL			$2,575		$8,245	**$10,820**
F. OTHER DIRECT COSTS						
1. Materials and Supplies					$8,392	$8,392
2. Thermal Imaging Flight					$8,008	$8,008
3. Laboratory Analysis					$4,375	$4,375
4. Postdoctoral Stipend (Hagedorn)					$4,583	$4,583
5. Other						
a. HIG Engineering Support			$500			$500
b. Equipment maintenance					$850	$850
Total Other Direct Costs		*$0*	*$500*	*$0*	*$26,208*	**$26,708**
G. TOTAL DIRECT COSTS		***$6,110***	***$13,183***	***$4,102***	***$80,075***	**$103,470**
H. INDIRECT COSTS*		***$1,069***	***$2,307***	***$718***	***$10,688***	**$14,782**
I. TOTAL DIRECT + INDIRECT COSTS		***$7,179***	***$15,490***	***$4,820***	***$90,763***	**$118,252**
**CESU overhead rate of 17.5% of total direct costs*						
(excluding equipment)						

BUDGET JUSTIFICATION

PERSONNEL

Principal Investigators

Dr. Craig Glenn – An expert in submarine groundwater discharge investigations using multiple techniques such as stable isotope geochemistry, seep flow measurement, and TIR. He will be the team leader, and will supervise the geochemical and the TIR investigations. Dr. Glenn's monthly regular salary rate is $9,159 and one-half month of funding is requested.

Dr. Aly El-Kadi – is an engineer and hydrogeology professor, and researcher with expertise on numerical groundwater and transport modeling. He will be supervising the tracer test design and the numerical modeling. Dr. El-Kadi's monthly summer salary rate is $11,053 and one-half month of funding is requested.

Dr. Henrieta Dulaiova – has extensive experience studying submarine groundwater discharge in various geological settings. She uses stable- and radioisotope tracers and direct methods to study spatial distribution and temporal variability of SGD. She will be supervising the radon and radium data collection and analysis, current meter deployment, as well as aiding in the geochemical interpretations. Dr. Dulaiova's monthly summer salary rate is $8,710 and one-half month of funding is requested.

Meghan Dailer – is a marine biologist that specializes in stable isotope interpretations of marine plants. She has over four years of experience working at the study site and will supervise marine field operations. Ms. Dailer's monthly regular salary rate is $4,584 and one-half month of funding is requested.

Other Personnel

Robert Whittier – is a hydrogeologist with expertise in groundwater and transport modeling, and applied hydrogeology. He will aid in the tracer study design, oversee the tracer injection and sample collection, and be the primary modeler. Mr. Whittier's annual rate is $47,472 and a total of 2.25 months of funding are requested.

Jacque Kelly – is a geology PhD candidate with expertise in analyzing TIR data. Two months of summer salary at $2,177 per month is requested.

Christine Waters – is a geology MS candidate that specializes in radiogenic tracers and SGD. Two months of summer salary at $2,093 per month is requested.

Joe Fackrell – is a geology MS candidate that specializes in the geochemical evolution of groundwater and SGD. Two months of summer salary at $2,093 per month is requested.

Undergraduate Student – will be used on-site to collect samples and perform other miscellaneous tasks. The undergraduate annual rate is $24,000 and one month of support is requested.

EQUIPMENT

Acoustic Doppler Current Profiler (a YSI AquaDopp Profiler®) **–** An acoustic instrument that is deployable at the seeps to measure the freshwater flow field in three dimensions. This device allows time series measurements of seep discharge, providing data necessary to compute the freshwater and effluent flux to the ocean. Cost for the profiler is $19,000. A price quotation and clarifying email are attached.

TRAVEL

Travel from Honolulu, Oahu, Hawaii to Lahaina, Maui, Hawaii via Kahului, Maui, Hawaii will be necessary to complete the work described in Tasks 2 and 4**.** The details of the travel are provided in the table below.

Trip 1 (Objective 2)				
Purpose:	Conduct an aerial sea surface Thermal Infrared mapping of the Kaanapali Area, Maui, Hawaii			
No. of Persons Traveling	**Number of Days**	**Depart From**	**Arrive At**	**Mode of Travel**
5	2	Honolulu, Oahu, Hawaii	Kahului, Maui, Hawaii	Air

Trip 2 (Objective 4)				
Purpose:	Collect seep samples to characterize background fluorescence, perform a coastal radon mapping and monitoring, and conduct geo/isotopic chemistry sampling			
No. of Persons Traveling	**Number of Days**	**Depart From**	**Arrive At**	**Mode of Travel**
1	3	Honolulu, Oahu, Hawaii	Kahului, Maui, Hawaii	Air
2	4	Honolulu, Oahu, Hawaii	Kahului, Maui, Hawaii	Air
4	5	Honolulu, Oahu, Hawaii	Kahului, Maui, Hawaii	Air

OTHER DIRECT COSTS

MATERIALS AND SUPPLIES

Items under this category are:

- A TIR Imaging Computer will be used for real time processing of data during the mapping flight ($4,602);
- An interface for the TIR imaging computer to transfer data from the infrared sensors to the TIR computer ($1,950); and
- Direct drive piezometers that will be installed at submarine sampling points to facilitate sample collection ($1,840).

Price quotations or internet pricing is provided for each item.

THERMAL IMAGING FLIGHT

Flight Services with a thermal infrared imaging camera are required to map the sea surface temperature distribution. This is critical to success of the project since it provides high resolution temperature mapping of the study area to detect seeps that could be missed by wading or boat surveys. A price quotation for $8,008 for these services is attached.

LABORATORY ANALYSIS

Isotope/geochemistry/nutrient samples will be taken at eight locations. Three samples will be collected at each location plus a duplicate sample. The cost of sample analysis and the supplies to collect the samples will be $4,375. Attached is a sample analysis table and price schedules from the University of Hawaii and University of Washington analytical laboratories.

POSTDOCTORAL STIPEND

Dr. Klaus Hagedorn – is a geochemist and hydrogeologist with expertise in using geochemical tracers to partition groundwater fractions between various transport paths. He will be a key member is collecting and analyzing the stable isotope and geochemical data. As part of his research fellowship he will increase his expertise in using isotope geochemistry to differentiate a mixed marine and freshwater environment between natural, non-wastewater and wastewater anthropogenic sources. Dr. Hagedorn has an annual stipend of $55,000 and one month of funding is requested.

OTHER

Included under this category are engineering support services from the Hawaii Institute of Geophysics and Planetology Engineering Support Team ($500) and equipment maintenance costs ($850).

INDIRECT COST RATE

17.5 percent of modified total direct costs less equipment (CESU rate).

ATTACHMENTS:

Price Quotations for Materials and Supplies and Other Costs

Fringe Benefit Rate Schedule

Indirect Cost Rate Agreement

PRICE QUOTATIONS FOR SUPPLIES AND OTHER COSTS

FRINGE BENEFIT RATE SCHEDULE

INDIRECT COST RATE AGREEMENT

Date:	**21-Oct-10**
Quote #:	**Q1010207**
From:	**Judah Goldberg**
Phone:	**410-295-3733 Ext.2**
Email:	**judah@nortekusa.com**

NortekUSA

Quotation

To:	**University of Hawaii**
Attn:	**Henrieta Dulaiova**
Phone:	**808-956-0720**
E-mail:	**hdulaiov@hawaii.edu**

Dear Henrieta,
NortekUSA is pleased to provide you this quote for one (1) 1 MHz Aquadopp Profiler with right-angle transducer head.

Aquadopp Profiler

Item #	Product code	Product description	Price
1	S-AQUPRO-ASP-1MHZ	Aquadopp profiler 1 MHz right-angle head (ASP)	$ 15,450.00
2	P-MEMO-9MB-MOTH	9 MB of memory on motherboard (M8)	$ 0.00
3	P-PRES-PA10-50M	Pressure sensor, 0-50 m	$ 100.00
4	P-COMP-TILT	Compass and tilt sensor	$ 0.00
5	P-CAB-8P-INL-10M	10-m polyurethane cable with 8-pin connector	$ 0.00
6	P-HARN-RS232-ANA-IN	RS-232 + analog in	$ 0.00
7	P-BATT-ALKA-100WH	Alkaline internal battery pack (100 Wh)	$ 0.00
		Total Cost	**$ 15,550.00**
		Quantity	1
		Sub Total	**$ 15,550.00**
		Estimated freight and insurance	$ 300.00
		Total	**$ 15,850.00**

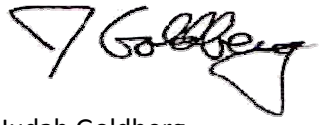
		Optional Products and Services	
A		1 Year Extended Warranty - available years 2-5	$ 777.50

NortekUSA • 222 Severn Avenue • Building 14 • Suite 102 • Annapolis • MD • 21403
Phone: 410-295-3733 • Fax: 410-295-2918

Terms & Conditions

1. All prices listed in US Dollar.
2. Quote valid for 30 days.
3. Payment terms are 30 days net
4. Sales tax may be applicable for certain delivery locations.
5. Freight and insurance will be added to invoice unless otherwise notified.
6. Purchase Orders should be faxed to the main office in Annapolis, Maryland
7. NortekUSA does not provide software source code or detailed hardware drawings.
8. Software is sold under a license that restricts use of the software to computers belonging to members of your immediate group.
9. One-year manufacturer's warranty on defects and workmanship.
10. Estimated delivery: 5 weeks from date of order
11. Ex Works Oslo, Norway

Cheers,



Judah Goldberg

NortekUSA • 222 Severn Avenue • Building 14 • Suite 102 • Annapolis • MD • 21403
Phone: 410-295-3733 • Fax: 410-295-2918

Subject	**Re: ADCP Quotation**
From	Henrieta Dulaiova <hdulaiov@hawaii.edu>
Date	Tuesday, February 15, 2011 11:31 am
To	Robert Brent Whittier <whittier@hawaii.edu>

Hi Bob, a quote is attached. Let me know if this is sufficient. I got a newer one also but he forgot to include the firmware upgrade for the high resolution option ($3,500). The base price hasn't changed at $15,500.
Henrieta

On Feb 15, 2011, at 11:20 AM, Robert Brent Whittier wrote:

> Henrietta,
>
> Now that the Phase I of the Lahaina Tracer Study is moving forward it is time to start working seriously on the proposal. The CESU process requires that we include price quotations for any equipment that we purchase. I believe that you already got a quote for the ADCP current profiler. Could you send it to me? I trying to get everything together.
>
> Thanks,
>
> Robert B. Whittier, Hydrogeologist
> University of Hawaii, Dept. of Geology and Geophysics
> 2525 Correa Rd., HIG 217
> Honolulu, Hi 96822
>
> Ph.: 808 956-4777 Cell.: 808 387-4869
> Fax.: 808 956-5512
>
> email: whittier@hawaii.edu
>
>

Henrieta Dulaiova
Assistant Professor
Department of Geology & Geophysics
POST 707
SOEST, University of Hawaii
Honolulu, HI 96822
Tel: (808) 956-0720
Fax: (808) 956-5512
http://www.soest.hawaii.edu/GG/FACULTY/hdulaiov/

Hi Bob, a quote is attached. Let me know if this is sufficient. I got a newer one also but he forgot to include the firmware upgrade for the high resolution option ($3,500). The base price hasn't changed at $15,500.
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Robert B. Whittier, Hydrogeologist
University of Hawaii, Dept. of Geology and Geophysics

2525 Correa Rd., HIG 217
Honolulu, Hi 96822

Ph.: 808 956-4777 Cell.: 808 387-4869
Fax.: 808 956-5512

email: whittier@hawaii.edu

_____

Henrieta Dulaiova
Assistant Professor
Department of Geology & Geophysics
POST 707
SOEST, University of Hawaii
Honolulu, HI 96822
Tel: (808) 956-0720
Fax: (808) 956-5512
http://www.soest.hawaii.edu/GG/FACULTY/hdulaiov/

Windows® . Life without Walls™ . Dell recommends Windows 7.

Print Summary

Latitude E6400 XFR

Starting Price	$5,172.00
Instant Savings	$570.00
Subtotal	**$4,602.00**

Finance at a fixed rate of 2.25% on select Latitudes

As low as **$115.00**/mo.

Dell Business Credit | Apply

Discount Details

Preliminary Ship Date: **4/6/2011**

My Selections **All Options**

- **Latitude E6400 XFR**

Date	3/9/2011 1:00:13 PM Central Standard Time
Catalog Number	4 Retail 04

Catalog Number / Description	Product Code	Qty	SKU	Id
E6400 XFR: Latitude E6400 XFR	E64XFR	1	[224-5128]	1
E6400 XFR: Intel® Core™ 2 Duo P9700 with VT (2.80GHz) Discrete graphics with PC Card	M97DPF	1	[317-2731]	2
Operating Systems: Genuine Windows® 7 Professional, 32-bit, no media	W7P3QA	1	[330-6043][330-6322][468-6978]	11
Productivity Software: No Productivity Software	NOPSW	1	[421-3872]	22
Hardware Support Services: 3 Year Basic Limited Warranty and 3 Year NBD On-Site Service	Q3YOS	1	[992-3352][992-7190][993-5918][993-5977]	29
Warranty Extension Notice: Warranty Extension Notice – Ensure coverage with notification when your warranty is about to expire	WEN	1	[909-3149]	422
System Recovery: Recovery Media for Genuine Windows® 7 Professional,32bit,Multiple Language	M7P32M	1	[421-2990]	47
Security Software: Trend Micro Worry-Free Business Security Services, 30-days	TMWF30	1	[410-0329]	38
Memory: 2.0GB, DDR2-800 SDRAM, 2 DIMMS	2G2D8	1	[311-8825]	3
Primary Storage: 128GB Solid State Drive	128SSDM	1	[341-8897]	8

Primary battery: 6 Cell Battery	6C	1	[312-0896]	27
Primary Optical Device: 8X DVD+/-RW w/Roxio and Cyberlink PowerDVD™, NO Media	8XDVRWN	1	[313-6513][421-4370][421-4539]	16
Wireless LAN (802.11): Intel® WiFi Link 5300 802.11a/g/n Draft Mini Card	IWIF53V	1	[430-3362]	19
Bluetooth: Dell Wireless® 370 Bluetooth Module	BT370	1	[430-3090]	13
LCDs: 14.1 inch WXGA LED display with DirectVue Technology and Camera	NTSCM	1	[320-7947][421-1201]	10
Modem: Internal Modem	MODEM	1	[313-7709]	14
Internal Keyboard: Internal Backlit English Keyboard	ENG	1	[330-1652][330-3643]	4
System Documentation: No System Documentation	NODOCS	1	[313-3673]	25
Energy Star & EPEAT: Energy Star 5.0 Enabled / EPEAT SILVER	ESTAR	1	[467-5653]	40
Systems Management: No Intel® vPro™ Secure Advanced Hardware Enabled Systems Management	CSMD	1	[330-0884]	21
Mobile Broadband: No Mobile Broadband Selected	NOMBB	1	[468-4760][468-6119]	114
Processor Branding: Intel 2 Core Duo Processor	IC2NB	1	[310-8319]	749
OS Labels: Windows 7 Sticker	WIN7I	1	[330-6734]	750
AC Adapter: 90W A/C Adapter (3-pin)	90AC3P	1	[330-0876][330-0879]	15
Mouse: Dell Laser Mouse	LASER	1	[330-2526]	12
Carrying Case: E6400 XFR Shoulder Strap - facilitates easy transportation of your rugged notebook	STRAP	1	[317-1152]	28
Installation Services: No Onsite System Setup	NOINSTL	1	[900-9987]	32

Print

snFG05

Photon 320 Accessory - Ether Module

Price: $1,950.00

Quantity: 1 Add to Cart

This 100/1000 baseT Ethernet Interface module allows for camera control along with real-time strea uncompressed video data from the Photon 320 via standard ethernet hardware.

Module includes:

- GigE Adapter
- 68-pin to 15-pin interface cable
- Power supply

FLIR's Ethernet Module for Photon provides camera control functions, and converts serial LVDS into streaming uncompressed video data. The Module allows capture of both 8-bit digital data and the fu digital data. Analog video is also output via separate BNC connector.The Module interfaces into a sta 45 Ethernet network and runs at standard 100 megabit or full gigabit Ethernet speed.

The Ethernet Module includes the Ethernet interface adapter, camera cabling, and power supply. Th obviate the need for several items included in the Photon Accessory Kit, however the Ethernet Modu the camera to have the wearsaver adapter connector (250-1094-00) and the wearsaver cover (261- installed on the Photon 320 camera. These items are available as separate accessories item for the camera, and priced at $75 and $50, respectively.

The Photon control software (GUI) provides Ethernet Module support to allow camera control and vi

in a host computer window. The camera control GUI is a free download at **www.corebyindigo.com/service/softwareupdates.cfm**.

The Photon SDK, a separate optional accessory, also provides camera control functionality. The SDK the part number for ordering purposes is 110-0102-46.

SKU: **421-0025-00**

You may be interested in these items

Photon Accessory - SDK (Embedded & Windows)
Price: $995.00
Add to Cart

Photon 320 Accessory - Wearsaver Adapter
Price: $80.00
Add to Cart

Photon Accesso Wearsa Cover
Price: $3
Add to Ca

Photon 320 Accessory - EMI Rear Cover
Price: $275.00
Add to Cart

Direct Drive Piezometer Materials List			
Item	**Qty**	**Cost**	**Total**
615 piezometer w/o shield 6" Compressn Fitting	5	$101.85	$509.25
615S Piezometer w/shield 6" Barb fitting	5	$166.84	$834.20
615 Drive Head Assembly	2	$109.61	$219.22
Slide Hammer	1	$177.51	$177.51
Shipping			$100.00
Total			**$1,840.18**

EQUIPCO
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Relial
N

Solinst 615 Drive-Point Piezometers

The Model 615 Drive-Point Piezometer uses a high quality stainless steel Piezometer Tip, 3/4" NPT pipe for drive extensions and LDPE or Teflon sample tubing, if desired. Combine these with an inexpensive Slide Hammer and you have a complete system.

Model 615 Drive-Point Piezometers

Part No.	Description	Price
102081	615 Drive Point Piezometer 1 ft SS c/w barb	~~$102.00~~ **$98.94**
108538	615C Drive Point Piezometer 1 ft SS with 1/4″ Compression	~~$124.00~~ **$120.28**
100929	615 Drive Point Piezometer 6″ SS c/w barb	~~$87.00~~ **$84.39**
103160	615 Drive Point Piezometer 6″ SS with 1/4″ Compression	~~$105.00~~ **$101.85**
102932	615 Manual Drive Head Assembly for the Drive Point Piezometer	~~$113.00~~ **$109.61**
101387	615 Manual Drive Head for the Drive Point Piezometer	~~$31.00~~ **$30.07**
102174	615 Manual Slide Hammer - 25 lb for the Drive Point Piezometer	~~$183.00~~ **$177.51**
102475	615 Manual Tubing By-pass for the Drive Point Piezometer	~~$39.00~~ **$37.83**
101057	615 SS NPT Cap	~~$6.92~~ **$6.71**
100620	615 SS NPT Coupling	~~$12.00~~ **$11.64**
101069	615 SS NPT Extension 1 ft length	~~$24.00~~ **$23.28**
101070	615 SS NPT Extension 2 ft length	~~$43.00~~ **$41.71**

101071	615 SS NPT Extension 3 ft length	~~$63.00~~ **$61.11**
102842	615N Drive Point Piezometer 1 ft SS (no barb)	~~$99.00~~ **$96.03**
102841	615N Drive Point Piezometer 6″ SS (no barb)	~~$83.00~~ **$80.51**
102412	615S Replacement Shield 1 ft SS for the Drive Point Piezometer	~~$92.00~~ **$89.24**
104370	615S Replacement Shield 6″ SS for the Drive Point Piezometer	~~$56.00~~ **$54.32**
102312	615S Shielded Drive Point Piezometer 1 ft SS c/w barb	~~$238.00~~ **$230.86**
104366	615S Shielded Drive Point Piezometer 6″ SS c/w barb	~~$172.00~~ **$166.84**
102319	615SN Shielded Drive Point Piezometer 1 ft SS (no barb)	~~$233.00~~ **$226.01**
104637	615SN Shielded Drive Point Piezometer 6″ SS (no barb)	~~$168.00~~ **$162.96**

Veteran Owned Business
California State Certified Small Business

Air Flight Service

Mapping Photography
GPS Positioning
Digital Imagery
Airborne Sensor Platforms
Photo Library

Pacific Islands Operations 10 Lagoon Dr. Bldg 421 Hangar 134 Honolulu International Airport, Hawaii (808) 927-3334

Monday, March 14, 2011

Craig,

The Hourly Flight rates listed below include fuel (wet) based on $6.75 per gallon. A fuel surcharge may be applied if the price of avgas increases more then $0.25 per gallon. The Hourly Flight rates do not include the Pilot's time.

Aircraft: access is sole source, Twin Piper Navajo N3949W (wet)

Daily Occupancy fee is equal to two Flight Hours per day, prorated over the duration of the operation.

Option A:
Hourly Flight Rate: $1050.00 per hour, engine start to engine shutdown

Option B
Hourly Flight Rate for Pre-paid Flight Hours: $950.00 per hour engine start to engine shutdown

Pilot Rates

Local Operations Based out of Honolulu HNL
Four hour minimum: $340.00 per day
Additional Hours: $85.00 per hour

Outer Islands Based Operations
Eight hour minimum: $680.00 per day
Additional Hours: $85.00 per hour

Per Diem

Option A
Full Per Diem: $285.00 per day (lodging $165.00, meals $65.00 (prorated), auto-rental $55.00 all expenses will be assessed a GO&A fee of 27%.

Option B
Client to cover lodging & transportation expenses; AFS to provide the daily meals allowance of $65.00 per day (prorated) plus 27% GO&A fee.

Option C
Client to cover all travel expenses including, put not limited to lodging, transportation and provide the crews meal allowance at $65.00 per day.

Ground or Additional Crew Support: $85.00, flight planning $125.00, per hr., FMS usage fee $100.00 per day.

Engine Run: $450.00 per hour invoice in tenths of an hour increments

Oxygen Fees: All oxygen service fees will be invoiced at cost. Please note, oxygen service is not available at all airports.

Rich

Mainland Office 2220 Calle De Luna, Santa Clara, California 95054 (408) 988-0107 Fax: (408) 988-0729

Deployment Estimate

$8,008.00

Actual

Flight Time, includes all flight time, transits, enroute, climbs, descents, on-site, turns, etc	5.0	Notes: Twin Piper Navajo, **N3949W** with two Pilots, project Thermo IR, area Molokai-Maui-Molokai **Single day ops May 2011**		0.0	Notes:
Days on Deployment, includes day of departure & day of return.	**1**			**0**	

Services	Estimate Units	Per Unit	Estimated Impact	Actual Units	Invoiced
Ground Support Install	**4.0**	$85.00	$340.00		$0.00
Engine Run Times	**0.5**	$450.00	$225.00		$0.00
Outbound Flt-Hrs.	**1.0**	$950.00	$950.00		$0.00
Flight Planning & ATC coordination	**2.0**	$125.00	$250.00		$0.00
Data Flight Hours, from staging base, includes climbs, descents, enroute to & from the area of interest, time-over-target and turns.	**3.0**	$950.00	$2,850.00		$0.00
Pilot Time, up to eight consecutive hours per day.	**1.0**	$680.00	$680.00	**0.0**	$0.00
FMS Navigational Unit	**1.0**	$100.00	$100.00	**0.0**	$0.00
Per Diem, includes daily Lodging, Meal allowance, incidentals such as laundry, phone calls, faxes, copies, tips & taxes, prorated for partial days	**0.0**	$285.00	$0.00	**0.0**	$0.00
Transportation, includes mid-size crew rental car, fuel, taxi, tip in transit, etc.	**0.0**	$55.00	$0.00	**0.0**	$0.00
Extended Pilot Support exceeding eight consecutive hours per day or 2nd pilot	**8.0**	$85.00	$680.00		$0.00
Return Flt-Hrs.	**1.0**	$950.00	$950.00		$0.00
Ground Support Removal	**3.0**	$85.00	$255.00		$0.00
Daily Flight Minimum, number of days where the two hour flight minimum was not met.	**0.0**	$950.00	$0.00		$0.00
Sub-Total			**$7,280.00**		**$0.00**
Over-run buffer		**10%**	$728.00	Notes:	
Deployment Estimate			**$8,008.00**		

Prepaid Flight-Time	
Prepaid Flight-Time Discount, if you elect to prepay the estimated Flight Hours the Flight Rate will be reduced by $50.00 per Flight Hour.	**$4,750.00**

Deposit (Required unless Flight-Hours are prepaid)	**30%**	**$2,402.40**	Balance less Deposits, Payments or Prepaid Flt-Time	
Post Flight Minimum Payment (Required unless Flight-Hours are prepaid)	**30%**	**$2,402.40**	**Balance (Net 30)**	**TBD**

PHASE 1 GEOCHEM LAB ANALYSES

NO. SITES	No. of Samples	
8	25	
		Lab Location
δ^{15}N (algae)	$15.00	University of Hawaii
δ^{15}N δ^{18}O (Nitrate)	$60.00	University of Hawaii
δ^{13}C Total Inorg. C	$20.00	University of Hawaii
Total nutrients	$11.50	University of Washington
Specific Nutrients	$36.00	University of Washington
Total P&N	$12.50	University of Washington
Chlorophyl a	$10.00	University of Washington
Filters, bottles, & shipping	$10.00	
Cost/Sample	$175.00	
Total Sampling Costs:	**$4,375.00**	

Subject	**Price Inquiry**
From	Elizabeth Gier <egier@hawaii.edu>
Date	Monday, March 14, 2011 11:28 am
To	whittier@hawaii.edu

Hello,

Thank you for your interest in our lab. Here are the prices you requested.

delta 15N of algae with sample prep $15/sample
delta 15N of nitrate in water $60/sample
delta 13C DIC of water $20/sample

If you have any more questions, pleas let me know.

Elizabeth Gier

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Dr. Elizabeth Gier
Isotope Biogeochemistry Laboratory, Manager
University of Hawaii
Department of Geology and Geophysics
1680 East West Rd.
POST 726
Honolulu, HI 96822
egier@hawaii.edu
(808) 956-5362

School of Oceanography

About People News Calendar Academics Research Vessels Services

Technical Services

Marine Chem Lab | Ocean Engineering | Pooled Eqmt | P-Test Vessel | Seaglider | Test Tank

Marine Chemistry Laboratory

The Marine Chemistry Laboratory at the School of Oceanography provides marine and freshwater analytical services to the University and oceanographic communities. We are an accredited laboratory with the State of Washington. The lab specializes in the analyses of nutrients, total N and total P, salinity, chlorophyll, oxygen, DOC in aqueous samples, and OC in particulate samples. Prices and other analyses are listed below:

ANALYSIS	HOMEBASE OPERATIONS	SHIPBOARD ANALYSES
Salinity	Analyses are run on Guildline models 8400B and 8410 Portasal - Calibration is with IAPSO Standard Seawater	Analyses are run on Guildline models 8400B and 8410 Portasal - Calibration is with IAPSO Standard Seawater
Oxygen	Analyses are run using the Carpenter (modified Winkler) with a Metrohm 765 Dosimat buret	Analyses are run using the Carpenter (modified Winkler) with a Metrohm 765 Dosimat buret
Nutrients (phosphate, silicate, nitrate, nitrite, & ammonia)	Analyses and calibration follow the protocols of the WOCE Hydrographic Program using a Technicon AAII system	Analyses and calibration follow the protocols of the WOCE Hydrographic Program using a Technicon AAII system
Chlorophyll a and phaeopigments	Analysis is acetone extraction and fluorometric detection on a Turner Designs TD-700 fluorometer	
Dissolved Organic Carbon (aqueous samples)	Analysis is with a Shimadzu TOC-Vcsh DOC analyzer	

Total Organic Carbon, Nitrogen, and Hydrogen (solid samples)	Analysis is by Exeter Analytical CE-440 CHN analyzer	

Oceanography chemical analyses price list

Nutrients: (PO4, Si(OH)4, NO3, NO2, NH3) all ions included in base price	$11.50 each $17.00 each if dilution required Syringe filters for samples: $2.00 each
Total N&P	$12.50 each $18.00 each if dilution required
Chlorophyll a	$10.00 each
Dissolved Organic Carbon (DOC)	Filtered liquid sample $17.00 each C clean filters $.70 each C clean sample vial $1.50 each
Particulate Carbon and Nitrogen (CHN)	On 25 mm filters $27.75 each Sediment samples: $38.75 each C clean filters $.70 each
Salinity	$11.50 each
TSS	$11.50 each
Turbidity	$5.75 each
Oxygen titrations	$12.50 each 1L suite of the six oxygen reagents: $420.00

Important notes:

- Add 15.6% to the total cost for any work done **not charged to a UW budget**.
- **Supplies** are not always available on short notice, so plan ahead and give them at least one full week's notice when requesting filters.
- **Logsheets** must be provided with the samples. They should include budget numbers, sample identification numbers, sampling locations, filtration volumes (where appropriate), and whether the sample contains fresh or marine water.
- Business is very good in the lab, so short **turnaround time** for sample analyses must be discussed with Kathy or Aaron ahead of time.
- Clients will be charged for any **shipping costs** associated with supplies and coolers

Please contact **Katherine Krogslund** (manager) and/or **Aaron Morello** (associate) PRIOR to sampling to discuss your project/sampling plans.

Address: University of Washington, School of Oceanography, Marine Chemistry Lab, 1492 NE Boat St., Seattle, WA 98105
Map: **Ocean Sciences Bldg.**, Room 346
Phone: (206) 543-9235 **Fax:** (206) 685-3354

Fringe Benefit Rates

The following table is provided as a guide for estimating fringe benefits. These are averaged rates by type of employee and should be used as starting point. If the actual fringe rate for a particular employee is known, it should be used instead.

Composite Fringe Rates (Effective July 1, 2010) - REVISED 2/1/11

Benefit	Subcode	Faculty	Staff	Grad Assistant	Casual Hire	Student	Overload
FICA	2x37	6.20%	6.20%	0.00%	0.00%0	.00%	0.00%
Medicare	2x43	1.45%	1.45%	0.00%	1.45%0	.00%	1.45%
Workers' Comp	2x41	0.40%	0.40%	0.40%	0.40%0	.40%	0.40%
Unemployment Insurance	2x42	0.44%	0.44%	0.44%	0.44%0	.00%	0.44%
Pension Accum	2x34	15.00%	15.00%	0.00%	0.00%0	.00%	0.00%
Pension Admin	2x36	0.00%	0.00%	0.00%	0.00%0	.00%	0.00%
Retiree Health	2x44	7.99%	7.99%	0.00%	0.00%0	.00%	0.00%
Vacation Reserve	2x49	0.00%	0.00%	0.00%	0.00%0	.00%	0.00%
Before Health Fund		**31.48%**	**31.48%**	**0.84%**	**2.29%**	**0.40%**	**2.29%**
Health Fund	Various	6.79%	6.79%	6.79%	0.00%0	.00%	0.00%
Composite		**38.27%**	**38.27%**	**7.63%**	**2.29%**	**0.40%**	**2.29%**

For further details and break downs see FY 2011 Fringe Rate Schedule.

1) For FY 2010, ORS has reinstated assessments for participation in the Federal APT vacation reserve. The assessment rate is 1.50%. **The composite rate for APTs on federal funds is 39.77%.**

2) Projects are assessed for FICA and Medicare when students employed on those projects do not meet the FICA exemption criteria. Please refer to Paul Kobayashi's May 4, 2010 memo.

3) Vacation reserve rate does not apply to cost shared salaries, which are normally committed from general, revolving or special funds.

4) Overload is exempt from FICA because it is not included in covered wages per the State's Section 218 agreement with the Social Security Administration.

5) Contact the respective college personnel office or the UH Office of Human Resources at 956-8643 on questions of eligibility for employee benefits.

Cost Sharing Fringe Benefit Rates

The following rates should be used to add or correct fringe benefit data with FastTrack Cost Sharing Input Form.

Fiscal Year	Period	Rate
FY 2001 - Present	7/1/00 - Present	22.00%

Fringe Benefit Memo Archive (FY 2005 - FY 2010)

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN:

ORGANIZATION:
University of Hawaii
2530 Dole Street Sakamaki D-200
Honolulu, HI 96822

DATE:11/22/2010

FILING REF.: The preceding agreement was dated 05/05/2009

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: INDIRECT COST RATES

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

EFFECTIVE PERIOD

TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
PRED.	07/01/2008	06/30/2009	38.40	On-Campus	Organized Res.
PRED.	07/01/2009	06/30/2012	36.70	On-Campus	Organized Res.
PRED.	07/01/2008	06/30/2012	20.60	Off-Campus	Organized Res.
PRED.	07/01/2008	06/30/2009	27.40	On-Campus	Instruction
PRED.	07/01/2009	06/30/2012	27.50	On-Campus	Instruction
PRED.	07/01/2008	06/30/2012	20.00	Off-Campus	Instruction
PRED.	07/01/2008	06/30/2009	26.90	On-Campus	Other Spon Act
PRED.	07/01/2009	06/30/2012	25.00	On-Campus	Other Spon Act
PRED.	07/01/2008	06/30/2012	19.00	Off-Campus	Other Spon Act
PRED.	07/01/2008	06/30/2009	25.40	On-Campus	Inst-Astronomy
PRED.	07/01/2009	06/30/2012	34.20	On-Campus	Inst-Astronomy
PRED.	07/01/2008	06/30/2012	19.50	Off-Campus	Inst-Astronomy
PRED.	07/01/2008	06/30/2009	3.10	(A)	Direct Projects
PRED.	07/01/2009	06/30/2012	2.70	(A)	Direct Projects
PRED.	07/01/2008	06/30/2009	8.90	(B)	(C)
PRED.	07/01/2009	06/30/2012	8.60	(B)	(C)
PRED.	07/01/2008	06/30/2009	53.50	(D)	Organized Res.
PRED.	07/01/2009	06/30/2012	50.00	(D)	Organized Res.
PRED.	07/01/2010	06/30/2012	7.10	Off-Campus	(E)

TYPE	FROM	TO	RATE(%)	LOCATION	APPLICABLE TO
PROV.	07/01/2012	Until Amended		(F)	

*BASE

Modified total direct costs, consisting of all salaries and wages, fringe benefits, materials, supplies, services, travel and subgrants and subcontracts up to the first $25,000 of each subgrant or subcontract (regardless of the period covered by the subgrant or subcontract). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, student tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

(A) Research Corp. of U.H.
(B) Applied Research Laboratory
(C) University Affiliated Research Center
(D) Kaka'ako campus including Gold Bond Building
(E) Intergovernmental Personnel Act Agreements

(F) Use same rates and conditions as those cited for fiscal year ending June 30, 2012.

ORGANIZATION: University of Hawaii
AGREEMENT DATE: 11/22/2010

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

Fringe benefits are specifically identified to each employee and are charged individually as direct costs. The directly claimed fringe benefits are listed below.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences.

OFF-SITE DEFINITION: For all activities performed in facilities not owned by the organization and to which rent is directly allocated to the project(s), the off-site rate will apply. Grants or contracts will not be subject to more than one indirect cost rate. If more than 50% of a project is performed off-site, the off-site rate will apply to the entire project.

DEFINITION OF EQUIPMENT
Equipment is defined as tangible nonexpendable personal property having a useful life of more than one year and an acquisition cost of $5,000 or more per unit.

The following fringe benefits are treated as direct costs:
FICA, WORKERS COMPENSATION, HEALTH/DENTAL/LIFE INSURANCE, MEDICARE, UNEMPLOYMENT INSURANCE, RETIREMENT, POST RETIREMENT BENEFITS, AND FACULTY VACATION RESERVE.

ORGANIZATION: University of Hawaii

AGREEMENT DATE: 11/22/2010

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Office of Management and Budget Circular A-21 Circular, and should be applied to grants, contracts and other agreements covered by this Circular, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:	ON BEHALF OF THE FEDERAL GOVERNMENT:
University of Hawaii	DEPARTMENT OF HEALTH AND HUMAN SERVICES
(INSTITUTION)	(AGENCY)
James R. Gaines	Wallace Chan
(SIGNATURE)	(SIGNATURE)
James R. Gaines	Wallace Chan
(NAME)	(NAME)
VP for Research	Director, Western Field Office
(TITLE)	(TITLE)
11/26/2010	11/22/2010
(DATE)	(DATE) 2601

HHS REPRESENTATIVE: Jeanette Lu

Telephone: (415) 437-7820